

Tilburg University

Validity of suicide statistics in Europe in relation to undetermined deaths

Värnik, P.; Sisask, M.; Värnik, A.; Arensman, E.; van Audenhove, C.; van der Feltz-Cornelis, C.M.; Hegerl, U.

Published in:
Injury Prevention

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
Värnik, P., Sisask, M., Värnik, A., Arensman, E., van Audenhove, C., van der Feltz-Cornelis, C. M., & Hegerl, U. (2012). Validity of suicide statistics in Europe in relation to undetermined deaths: Developing the 2-20 benchmark. *Injury Prevention*, 18(5), 321-325.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Validity of suicide statistics in Europe in relation to undetermined deaths: developing the 2-20 benchmark

Peeter Värnik,^{1,2} Merike Sisask,^{1,3} Airi Värnik,^{1,3} Ella Arensman,⁴
Chantal Van Audenhove,⁵ Christina M van der Feltz-Cornelis,⁶ Ulrich Hegerl⁷

¹Estonian-Swedish Mental Health and Suicidology Institute, Estonian Centre of Behavioural and Health Sciences, Tallinn, Estonia
²The Estonian Institute for Population Studies, Tallinn University, Tallinn, Estonia
³Institute of Social Work, Tallinn University, Tallinn, Estonia
⁴National Suicide Research Foundation, Cork, Ireland
⁵Katholieke Universiteit Leuven, UCAS, Leuven, Belgium
⁶Trimbos-instituut/Netherlands Institute of Mental Health and Addiction, Utrecht, The Netherlands
⁷Department of Psychiatry, University of Leipzig, Leipzig, Germany

Correspondence to: Peeter Värnik, Estonian-Swedish Mental Health and Suicidology Institute; Estonian Centre of Behavioural and Health Sciences, Öia 39, Tallinn 11615, Estonia; peetarv@suicidology.ee

Accepted 8 November 2011

ABSTRACT

Background The suicide rate is a macro indicator of the population's psychosocial wellbeing and an evaluation criterion of the effectiveness of suicide prevention strategies. A high level of injury deaths of undetermined intent (UD) is usually discussed in connection with the validity of suicide statistics. An effort is made to develop a criterion to characterise the quality of suicide statistics.

Methods Standardised rates of suicides (X60–X84) and UD (Y10–Y34) by the International Classification of Disease version 10 as an average for the past five available years were taken from the WHO European mortality database. Rate ratios were computed by dividing rates of UD by suicide rates.

Results There is considerable variation in suicide and UD rates among countries. The highest overall rates of UD were registered in Russia, Ukraine and Belarus, and the lowest in Greece, Spain and Italy. The EU-15 average UD rate of 1.97 and the rate ratio of 0.194 UD to suicides were combined into a '2-20 benchmark', in which the primary indicator is 2.0 UD cases per 100 000 and the secondary indicator is the proportion of UD to suicides 0.20 (20%), which enables countries to be clustered according to the quality of suicide statistics. The following countries satisfied the benchmark: Greece, Norway, Spain, The Netherlands, Luxembourg, France, Austria, Italy, Romania, Hungary, Ireland and Finland.

Conclusion This study used the developed '2-20 benchmark' in Europe to assess suicide registration quality in a particular country, to compare the relative position of countries, and to set a target for those European countries that have not yet achieved the benchmark.

sources of error are registration procedures,^{6 13–15} varying quality in diagnostics and mortality statistics,^{16 17} families' dissimulation (hiding of suicides), and political motives, as described by Wasserman and Värnik¹⁸ in relation to the former USSR and, more recently, by Pridemore.¹⁹ The coronial system of injury death registration, in which coroners have to adhere to the 'beyond reasonable doubt' rule in determining if there is convincing evidence for the verdict of suicide, favours higher levels of UD diagnosis.²⁰

Different researchers disagree on the extent to which variations in suicide rates can be explained by variations in the rates of UD. A consistent finding has been that suicides may be under-reported,^{9–11 14} and some individual-level studies have revealed that UD may reduce the reported suicide rate by approximately 10%.^{10 21} When the national suicide prevention strategy was formulated in the UK, for example, UD were added to suicide deaths.²² Chishti and colleagues⁶ disagreed with the assertion that misclassification was a reason for the differing suicide rates for most of the EU-15 member states. Lester²³ found that adding the rate of UD to the suicide rate did not greatly change the relative rankings of national suicide rates in the 15 countries studied. According to O'Carroll,¹⁴ it is unlikely that major conclusions based on suicide statistics are erroneous as possible errors are random. Nevertheless, some researchers argue that UD should be included in epidemiological studies on suicide.^{11 24 25}

Only a few studies have extended the investigation of UD (International Classification of Disease version 10 (ICD-10) codes Y10–Y34) beyond the suicide category (X60–X84). Although UD is the most common verdict in cases of probable suicide,⁶ other subcategories of death from external causes, ie, accidents (V01–X59) and homicides (X85–Y09), may also be misclassified as 'undetermined' in some situations.^{13 16 26 27} Moreover, chapter XX of ICD-10, 'external causes of morbidity and mortality', is not the only source of possible suicide misclassification. In chapter XVIII, 'ill-defined and unknown causes of mortality' (R96), 'other sudden death, cause unknown' (R98), 'unattended death' (in circumstances in which the body of the deceased is found and no cause is identifiable) and 'other ill-defined and unspecified causes of mortality' (from unknown causes, R99) may all hide suicides. Among deaths in which no distinction between suicide and accidental death can be made as well as those categorised as caused by 'mental and behavioural disorders due to psychoactive substance use' (ICD-10 F10–F19), some may be suicides.²⁸

The validity of suicide statistics and the comparability of national suicide rates are important issues in the fields of epidemiology and public health. A country's suicide rate is a macro indicator of the population's psychosocial wellbeing, and it has been applied as an evaluation criterion of the effectiveness of suicide prevention strategies and intervention programmes.^{1–4}

According to the latest official figures released by the WHO,⁵ suicide rates in European countries differ widely, and overall downward linear time trends in suicide mortality have been observed in most countries.^{6 7} However, variations in suicide rates can be real or can be caused by misclassification.^{6 8}

The 'injury death of undetermined intent' (UD) diagnosis is usually discussed in connection with the validity and comparability of suicide statistics.^{6 7 9–12} Various causes of suicide misclassification have been identified. The main potential

Original article

Suicide underreporting has key implications for policy development, research funding and the evaluation of preventive programmes. To develop adequate public health strategies, policy makers need reliable epidemiological and demographic research findings.²⁹ Knowing the magnitude of UD and what proportion of deaths from external causes is masked by it is, therefore, essential.

The aim of the current study was to make an attempt to develop one possible approach for dealing with the problem of 'hidden' suicides proposing a benchmark suitable for assessing the validity of suicide statistics in Europe in relation to UD.

MATERIALS AND METHODS

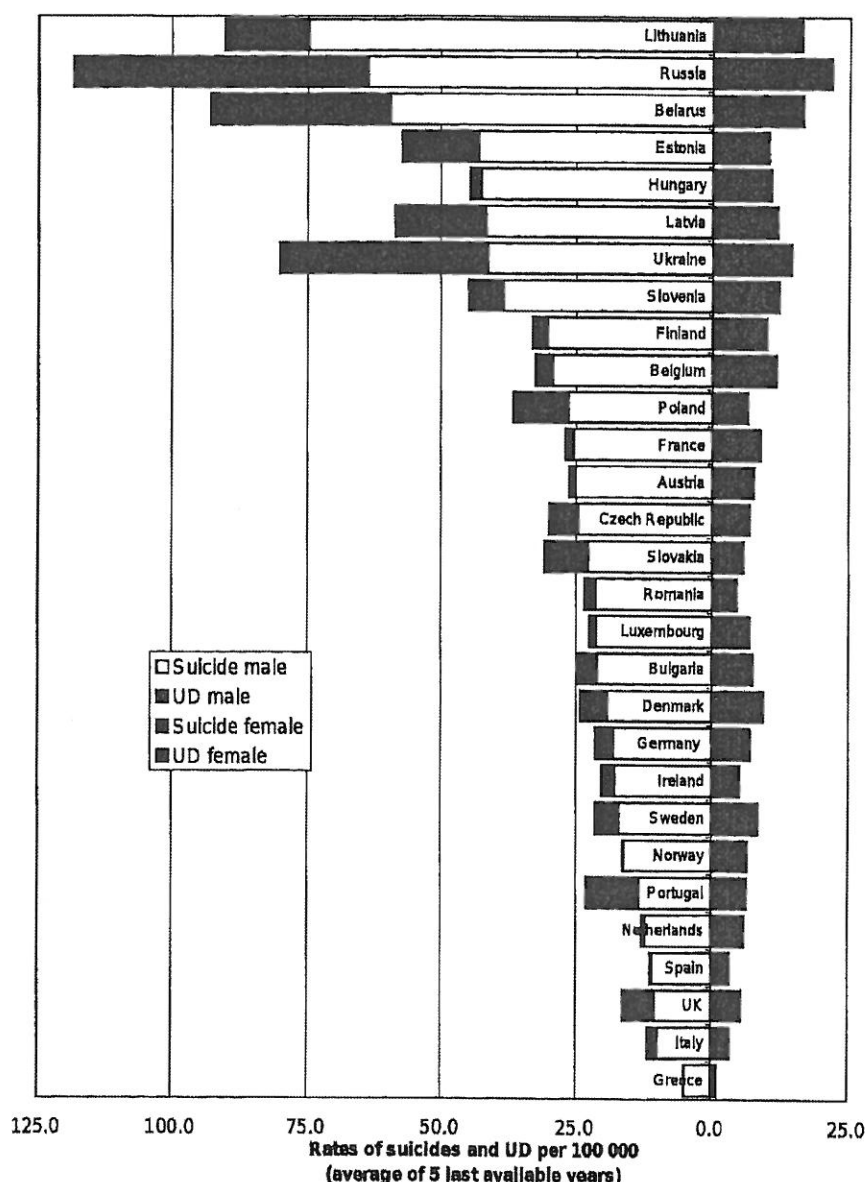
The following subcategories defined in chapter XX of ICD-10 ('external causes of morbidity and mortality') were taken from the WHO's European mortality database:⁵ suicides (X60–X84) and UD (Y10–Y34). The data refer to age-adjusted mortality rates by gender per 100 000 of population. The raw mortality

data are submitted by the WHO European member states to the WHO. WHO data are compiled, validated and processed in a uniform way in order to improve the international comparability of statistics. Standardised UD rates for Russia, which were not available in the WHO database, were obtained through a personal contact (A Nemtsov). All European countries for which data were available were included in the study (listed in figure 1).

Data for the past five available years were used to calculate average rates per 100 000 over this period. The most recent 5-year period available was chosen to reduce the possibility of being influenced by a particular year that may have had special characteristics in some countries and would therefore result in misleading findings. Rate ratios were computed by dividing rates of UD by suicide rates.

In addition to examining the data of all European countries, a subset of countries—EU-15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg,

Figure 1 Suicides and injury deaths of undermined intent (UD) in European countries.



The Netherlands, Portugal, Spain, Sweden, UK), which comprises those western European welfare states that joined the European Union before 2004, was used in analysis. The average rate of UD and the rate ratio of UD to suicides in these countries was used for setting the benchmark.

RESULTS

The general view of the suicide rate and the rate of UD in European countries is given in figure 1. The male suicide rate is taken as the basis for ranking countries. The registration of both male and female UD has the same general pattern within a country, although female rates are much smaller—the correlation between male and female UD rates by studied countries is 0.99. Therefore, later in the study gender-specific analysis was omitted and only data for the total population were used.

The overall rate of UD is by far the largest in six European countries, which were part of the Soviet Union before 1991. The Slavic republics of Russia, Ukraine and Belarus lead the list and form a group of their own with a rate of UD of over 20.0 per 100 000; the group of Baltic countries—Lithuania, Latvia and Estonia—has rate levels slightly below 10.0. In Portugal, Poland and Slovakia, the rate of UD is 5.0 or slightly over.

It is apparent that adding UD to suicides does not significantly change the rank order among countries—rank order correlation between the suicide rate and the suicide plus UD rate by studied countries is 0.96.

Another indicator to characterise the quality of suicide statistics—the rate ratio of UD to suicides—was combined with the overall rate of UD. In figure 2, the distribution of countries is given on the XY plane, in which the rate of UD is on the X-axis and the rate ratio of UD to suicides is on the Y-axis. The smallest rate ratio of 0.01 was found in Norway, while Portugal had a rate ratio of 0.78 and the UK 0.63. Latvia, Poland and Slovakia all had rate ratios of approximately 0.40.

The EU-15 average suicide rate per 100 000 was 10.15 and the average UD rate per 100 000 was 1.97 during 1997–2006. Therefore, the rate ratio of UD to suicides was 0.194. For purposes of convenience of use the numbers were rounded up to 2 and 0.20 (ie, 20%), respectively.

DISCUSSION

The quality of injury mortality statistics depends on various country-specific circumstances such as: (1) routines for registering suicides and other external causes of deaths;^{15 25 29} (2) the economic situation, which determines the resources available for medical and legal inquest into causes of death (autopsy, forensic autopsy, police/prosecutor investigation);^{15–17} (3) the strictness of and adherence to regulations concerning statistical data about causes of death;^{12 13} (4) varying proportions of suicide methods (hanging and jumping, which are usually easy to diagnose as suicides, versus drowning, using street drugs, or traffic accidents, in which the intent is more difficult to determine);³⁰ (5) cultural issues (stigma and denial at the family level);³¹ (6) financial implications for relatives, depending on life insurance regulations and practices;^{32 33} (7) the sociopolitical situation, which may bring forth wishes of the government to suppress one diagnosis of death at the expense of another.^{16 17}

All of the above combine to affect the final statistical outcome, although the strength of particular circumstances may vary widely across countries. The level of UD is positively correlated with the level of suicides over time, although the differences among countries are considerable.^{6 9} To describe the situation of the countries studied, it was deemed necessary to set benchmark figures using two indicators—the rate of UD and

the rate ratio of UD to suicides. EU-15 countries were chosen for constructing the benchmark because due to much higher gross domestic products per capita it was assumed that the availability of resources for death investigation in general should not be a limiting factor in these countries. Also these countries have been structurally more stable in the long term, while only some transitional countries of eastern Europe are showing signs of gaining stability.

The average rate of UD in the EU-15 countries is slightly below 2.0 per 100 000. A benchmark figure has to be easy to understand and remember while being achievable, initially by some countries and eventually by all countries to which it is applied. While the ideal target is set at no UD, it may be unachievable due to the inherent incompleteness of available data to forensic experts in some cases of death. There is genuine worry about levels of diagnosed UD being too high in many countries. The rate of 2.0 is thus considered to be a good benchmark at this point in time.

The benchmark for the rate ratio of UD to suicides is derived from the UD rate benchmark. The rate ratio is not a new measurement as it has been used before.^{12 15 18 27} Moreover, this indicator is easy to understand because the quantity of UD is primarily associated with the validity of suicide statistics. The average suicide rate in the EU-15 countries during the studied years is very close to 10.0, so the appropriate benchmark is 0.20 (2.0 divided by 10.0). As it also depends on the level of suicides: a higher suicide rate 'allows' for the rate of UD also to be somewhat higher and still be below the rate ratio component of the benchmark. When the suicide rate is low, the rate of UD also has to be very low to satisfy the benchmark.

The resulting composite indicator is the '2-20 benchmark' for measuring suicide registration quality. When countries are classified according to this benchmark, the following picture appears.

Sector 'A' in figure 2 includes countries that fare better against both benchmarks. This includes Norway, Greece, Spain, The Netherlands, Luxembourg, France, Italy, Austria, Romania, Hungary, Finland and Ireland. Most have belonged to this sector for a long time but some like Finland and Ireland have only achieved this quite recently.

Sector 'B' includes the countries Belgium, Bulgaria and Slovenia. These meet the rate ratio 0.20 benchmark but have a rate of UD over 2.0.

Sector 'C' includes the countries that do not meet the benchmark criteria for either indicator—Germany, Sweden, Czech Republic, Denmark, UK, Slovenia, Slovakia, Poland, Portugal, Estonia, Lithuania and Latvia. While some are close to benchmark levels, others are still quite far from these. Belarus, Ukraine and Russia also belong to this sector but have been left out of figure 2 because their very high rates of UD would dwarf the indicators of the other countries. It should be noted that in these countries verdicts of UD may mask fewer suicides and more homicides than in other studied countries, therefore the reduction in UD does not fully reflect an improvement in suicide data.

The letters 'A', 'B' and 'C' identifying the sectors can be understood and used as grades for the countries in terms of the quality level of their suicide registration. When efforts to reduce verdicts of UD begin to pay off, countries will gradually move from sector 'C' towards sector 'A'.

Limitations and implications

The '2-20 benchmark' does not make statistics more valid. It cannot be used to improve past statistics because proposing a universal estimation quota for adjusting suicide rates according to the level of possible 'hidden' suicides is impossible if only

Original article

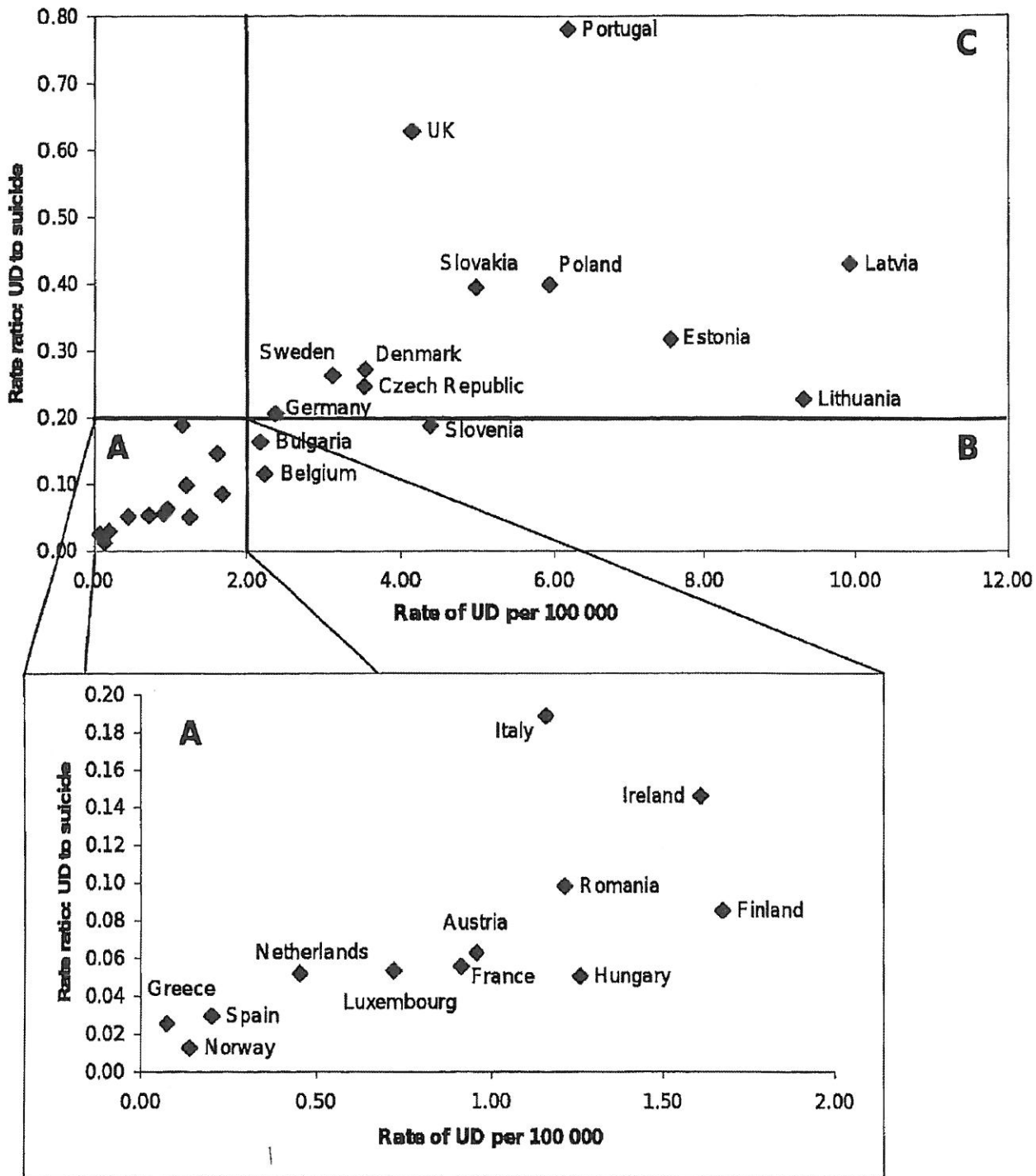


Figure 2 Injury deaths of undetermined intent (UD) according to data from five last available years in European countries. CIS Slavic countries (not shown in the figure 2 because of extreme values) have the following x-axis values: Russia (33.50; 0.99); Ukraine (21.52; 0.97); Belarus (19.48; 0.61).

aggregate-level data are available. To affirm with certainty how many UD should be reclassified as suicides needs an individual-level approach, for example, critical evaluation of a sample of death certificates issued.

The '2-20 benchmark' does, however, give an understanding of the level of validity of suicide statistics and sets alarm bells

ringing for countries in which benchmark criteria are not met. It is a general performance benchmark to be achieved.

It should be borne in mind that the numeric value of the benchmark is constructed on the basis of current levels of suicide and UD in Europe, it may be not directly applicable in the distant future or in completely different cultures.

What is already known on the subject

- ▶ The problem of 'hidden suicides' under the diagnosis 'injury death of undetermined intent (UD)' is an issue constantly challenging researchers in the field of epidemiology, demography and public health, usually discussed in connection with the reliability and comparability of suicide statistics.
- ▶ Several researchers combine suicide rates and the rates of UD for suicide research purposes.
- ▶ Our previous study about the structure of UD in ex-USSR Baltic and Slavic countries (P Värnik, 2010) has shown that undetermined deaths do not hide suicides alone, but also accidents and homicides could sometimes be diagnosed as undetermined.

What this study adds

- ▶ In the current study the '2-20 benchmark' has been worked out and is recommended for use in Europe to measure the quality of suicide statistics, for setting a target for those countries that have not yet achieved the benchmark and clustering countries accordingly.
- ▶ The level of two cases of UD per 100 000 inhabitants per year is the primary indicator.
- ▶ The secondary indicator is the proportion of UD to suicides during the same period for which a coefficient of 0.20 (20%) is the benchmark.
- ▶ The rationale behind these indicators is based on the exploration of the EU-15 average figures.

Policy implications

- ▶ Reliable suicide reporting has key implications for policy development, research funding and the evaluation of preventive and intervention programmes.

CONCLUSIONS

Two indicators have been developed to measure the situation regarding the handling of UD in Europe. The level of two cases per 100 000 inhabitants per year is the primary benchmark. The secondary indicator is the proportion of UD to suicides during the same period for which a coefficient of 0.20 is the benchmark. It is recommended to use the '2-20 benchmark' for measuring suicide registration quality, assessing the relative position of countries, and for setting a target for those countries that have not yet achieved the benchmark.

Acknowledgements The authors would like to thank Professor Alexander Nemtsov (Head of the Department of Informatics and System Investigations of the Moscow Research Institute of Psychiatry, Russian Federal Ministry of Public Health) for his help in collecting the data for Russia. Thanks are also due to Delaney Skerrett for his thorough linguistic and stylistic revision of the manuscript.

Funding The research reported in this paper has received funding from the European Community Seventh Framework Programme (FP/2007–2013) OSPI-Europe under grant agreement no 223138, and from the Estonian Ministry of Social Affairs.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The study is based on publicly available data and previously published sources.

REFERENCES

- Mann JJ, Apter A, Bertolote J, et al. Suicide prevention strategies: a systematic review. *JAMA* 2005;294:2064–74.
- Hegerl U, Wittmann M, Arensman E, et al. The 'European Alliance Against Depression (EAAD)': a multifaceted, community-based action programme against depression and suicidality. *World J Biol Psychiatry* 2008;9:51–8.
- Hegerl U, Wittenburg L, Arensman E, et al. Optimizing suicide prevention programs and their implementation in Europe (OSPI Europe): an evidence-based multi-level approach. *BMC Public Health* 2009;9:428.
- Gunnell D, Middleton N. National suicide rates as an indicator of the effect of suicide on premature mortality. *Lancet* 2003;362:961–2.
- WHO European Mortality Database (MDB). *European Mortality Database (MDB)*, WHO Regional Office for Europe. 2009. <http://data.euro.who.int/hmdb> (accessed 20 Jan 2009).
- Chishti P, Stone DH, Corcoran P, et al. Suicide mortality in the European Union. *Eur J Public Health* 2003;13:108–14.
- Bertolote JM, Fleischmann A. A global perspective on the magnitude of suicide mortality. In: Wasserman D, Wasserman C, eds. *Oxford Textbook of Suicidology and Suicide Prevention*. New York: Oxford University Press, 2009:91–8.
- Jenkins R. Addressing suicide as a public-health problem. *Lancet* 2002;359:313–14.
- Lester D. Time-series analysis of suicidal and undetermined deaths. *Percept Mot Skills* 1997;85:1242.
- Ohlberg A, Lonnqvist J. Suicides hidden among undetermined deaths. *Acta Psychiatr Scand* 1998;98:214–18.
- Linsley KR, Schapira K, Kelly TP. Open verdict v. suicide – importance to research. *Br J Psychiatry* 2001;178:465–8.
- Neelam J, Wessely S. Changes in classification of suicide in England and Wales: time trends and associations with coroners' professional backgrounds. *Psychol Med* 1997;27:467–72.
- Breiding MJ, Wiersma B. Variability of undetermined manner of death classification in the US. *Inj Prev* 2006;12(Suppl 2):i49–54.
- O'Carroll PW. A consideration of the validity and reliability of suicide mortality data. *Suicide Life Threat Behav* 1989;19:1–16.
- Värnik P, Sisask M, Värnik A, et al. Suicide registration in eight European countries: a qualitative analysis of procedures and practices. *Forensic Sci Int* 2010;202:86–92.
- Gavrilova NS, Samyionova VG, Dubrovina E, et al. Russian mortality crisis and the quality of vital statistics. *Popul Res Policy Rev* 2008;27:551–74.
- Samyionova VG, Dubrovina EV, Gavrilova NS, et al. Estimates of the real levels of violent death rates in Russia. *Public Health Dis Prev* 2005;3:14–23.
- Wasserman D, Värnik A. Reliability of statistics on violent death and suicide in the former USSR, 1970–1990. *Acta Psychiatr Scand Suppl* 1998;394:34–41.
- Pridemore WA. Measuring homicide in Russia: a comparison of estimates from the crime and vital statistics reporting systems. *Soc Sci Med* 2003;57:1343–54.
- Kelleher MJ, Corcoran P, Keeley HS, et al. Improving procedures for recording suicide statistics. *Ir Med J* 1996;89:14–15.
- Pounder DJ. Classifying suicide. *BMJ* 1992;305:472.
- National Suicide Prevention Strategy for England. London: Department of Health, 2002.
- Lester D. Miscounting suicides. *Acta Psychiatr Scand* 1992;85:15–16.
- Lucy S, Corcoran P, Keeley HS, et al. Socioeconomic change and suicide: a time-series study from the Republic of Ireland. *Crisis* 2005;26:90–4.
- O'Donnell I, Farmer R. The limitations of official suicide statistics. *Br J Psychiatry* 1995;166:458–61.
- Holding TA, Barraclough BM. Undetermined deaths – suicide or accident? *Br J Psychiatry* 1978;133:542–9.
- Värnik P, Sisask M, Värnik A, et al. Massive increase in injury deaths of undetermined intent in ex-USSR Baltic and Slavic countries: hidden suicides? *Scand J Public Health* 2008;38:395–403.
- Ott JJ, Winkler V, Kyobutungi C, et al. Effects of residential changes and time patterns on external-cause mortality in migrants: results of a German cohort study. *Scand J Public Health* 2008;38:524–31.
- Chenot L, Talishevska M. Epidemiology, medical demography and data quality issues in the former Soviet Union. *J Epidemiol Community Health* 2000;54:722–3.
- Värnik A, Köves K, van der Feltz-Cornelis CM, et al. Suicide methods in Europe: a gender-specific analysis of countries participating in the "European Alliance Against Depression". *J Epidemiol Community Health* 2008;62:545–51.
- Wasserman D, Värnik A, Dankowicz M. Regional differences in the distribution of suicide in the former Soviet Union during perestroika, 1984–1990. *Acta Psychiatr Scand Suppl* 1998;394:5–12.
- Yip P, Pitt D, Wang Y, et al. Assessing the impact of suicide exclusion periods on life insurance. *Crisis* 2010;31:217–23.
- Johannson DE. Review of "To Be or Not to Be: A Study of Suicide". *J Abnormal Social Psychol* 1935;30:134–8.



Validity of suicide statistics in Europe in relation to undetermined deaths: developing the 2-20 benchmark

Peeter Värnik, Merike Sisask, Airi Värnik, et al.

Inj Prev published online December 10, 2011
doi: 10.1136/injuryprev-2011-040070

Updated information and services can be found at:

<http://injuryprevention.bmj.com/content/early/2011/12/09/injuryprev-2011-040070.full.html>

These include:

References

This article cites 30 articles, 10 of which can be accessed free at:
<http://injuryprevention.bmj.com/content/early/2011/12/09/injuryprev-2011-040070.full.html#ref-list-1>

P<P

Published online December 10, 2011 in advance of the print journal.

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

Suicide (public health) (139 articles)
Suicide/Self harm (injury) (139 articles)
Epidemiologic studies (561 articles)

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:

<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:

<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:

<http://group.bmj.com/subscribe/>

Notes

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>